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TitraLab pH & Alkalinity content analyzer

USER MANUAL

05/2013, Edition 1

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Section 1 Specifications

These are subject to change without notice!

Performance specifications		
Measuring principle		Acid–base titration pH: potentiometric determination
Application area		Determination of pH and Alkalinity in water
Measuring range		Min. 0.1 mL or 10 mg/L CaCO ₃ Recommended max. 10 mL or 1000 mg/L CaCO ₃ Maximum titration system capacity of 20 mL or 2000 mg/L CaCO ₃
Resolution		Dependent on the selected units
Electrode		pH electrode, combined reference electrode, with built-in Pt 1000 sensor
Calibration		One, two or three-point calibration
Buffer recognition		Automatic: pH 2.00; 4.01; 7.00; 9.21 and 10.90 (at 25 °C)
Programs		pH measurement, 1 titration program, 1 calibration program
Languages		English, Spanish, French and Italian
Data logger		55 data records
Date/time		DD-MM-YYYY
Display		128 x 64 pt, backlit liquid crystal display
Keypad		7 membrane keys, splash-proof, PET, lifetime of >6 million key-presses
Burette	Resolution	0.001 mL
	Material of syringe	Polypropylene
	Volume	10 mL
	Tubes	White PTFE tubes
Inputs and outputs	Measuring electrode	BNC connector; maximum voltage ± 2.2 V, maximum current 1 mA. ¹
	Magnetic stirrer	RCA connector (cinch), maximum voltage 12 V, maximum current 150 mA ²
	Computer or printer	RJ11 telephone connector
	Power supply, external	Instrument input: 24 V \approx 45-65 Hz, 1 A External power supply delivered: Input: 100-240 VAC, ± 10 %, 50-60 Hz Output: 24 VDC, 1.33 A
	Mouse	Mini-DIN connector
Dimensions of measuring instrument and environmental conditions		
Enclosure material		ABS and enameled steel
Weight		approximately 4 kg
Dimensions		130 x 160 x 300 mm
Working temperature		+15 to +40 °C (+60 to +104 °F)
Storage temperature		–10 to +50 °C (+14 to +122 °F)
Air humidity		<80% relative humidity, non-condensing
Altitude requirements		Standard 2000 m (6562 ft) ASL (Above Sea Level)

Specifications

Certification	
Certification	CE
Electrical security	According CE, EN 61010
Electromagnetic compatibility	According CE, EN 50081-2 and EN 50082-2
Warranty	
Warranty	1 year

¹ Only for supplied electrode and BCN cable.

² Only for supplied stirrers.

NOTICE

The manufacturer is not responsible for any damages due to misapplication or misuse of this product including, without limitation, direct, incidental and consequential damages, and disclaims such damages to the full extent permitted under applicable law. The user is solely responsible to identify critical application risks and install appropriate mechanisms to protect processes during a possible equipment malfunction.

2.1 Safety information

Please read the entire user manual carefully before the equipment is unpacked, set up or put into operation. Pay attention to all danger and warning statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

To make sure that the protection provided by this instrument is not impaired, do not use or install this instrument in any manner other than that specified in these operating instructions.

⚠ DANGER

Indicates a potentially or imminently hazardous situation that, if not avoided, results in death or serious injury.

⚠ WARNING

Indicates a potentially or imminently hazardous situation that, if not avoided, could result in death or serious injury.

⚠ CAUTION

Indicates a potentially hazardous situation that may result in minor or moderate injury.



NOTICE

Indicates a situation that, if not avoided, could result in damage to the instrument. Information that requires special emphasis.

Note: Information that supplements points in the main text.

2.1.1 Warning labels

Read all labels and tags attached to the instrument. Failure to do so may result in personal injury or damage to the instrument. For symbols applied to the instrument, corresponding warnings are provided in the user manual.

	This symbol, if noted on the instrument, references the instruction manual for operation and/or safety information.
	This symbol may be found on an enclosure or barrier within the product and indicates a risk of electrical shock and/or death by electrocution.

General information



Electrical equipment marked with this symbol may not be disposed of in European domestic or public disposal systems after 12 August 2005. In conformity with European local and national regulations, European electrical equipment users must now return old or end-of life equipment to the manufacturer for disposal at no charge to the user.

Note: For return for recycling, please contact the equipment manufacturer or supplier for instructions on how to return end-of-life equipment, manufacturer-supplied electrical accessories, and all auxiliary items for proper disposal.

2.1.2 Safety information for the correct use of the instrument

- This instrument is intended only for indoor use.
- Do not vibrate or jolt the instrument.
- Do not open the instrument. Only authorized and trained personal is allowed to open the instrument. Follow the following safety information, in addition to any local guidelines in force.

Guarantee is voided if the instrument is not used in accordance with the guidelines present in this document.

2.1.3 Chemical and biological safety

⚠ WARNING

Potential danger in the event of contact with chemical/biological materials.
Handling chemical samples, standards and reagents can be dangerous.
Familiarize yourself with the necessary safety procedures and the correct handling of the chemicals before the work and read and follow all relevant safety data sheets.

⚠ WARNING

This instrument has been developed to meet the requirements of volumetric titration applications. It is therefore aimed at experienced users who have the knowledge required to operate the instrument and implement the security instructions enclosed. Remember that this instrument must not, under any circumstances, be used to perform test on living beings.

Normal operation of this instrument may involve the use of hazardous chemicals or biologically harmful samples.

- Observe all cautionary information printed on the original solution containers and safety data sheet prior to their use.
- Dispose of all consumed solutions in accordance with national regulations and laws.
- Select the type of protective equipment suitable to the concentration and quantity of the dangerous material at the respective work place.

2.2 Overview of product

Alkalinity is a measure of the capacity of water to neutralize acids. Alkaline compounds in the water such as bicarbonates, carbonates, and hydroxides remove H^+ ions and lower the acidity of the water (which means increased pH). They usually do this by combining with the H^+ ions to make new compounds. Without this acid-neutralizing capacity, any acid added to water would cause an immediate change in the pH. Measuring alkalinity is important in determining water ability to neutralize acidic pollution from rainfall or wastewater.

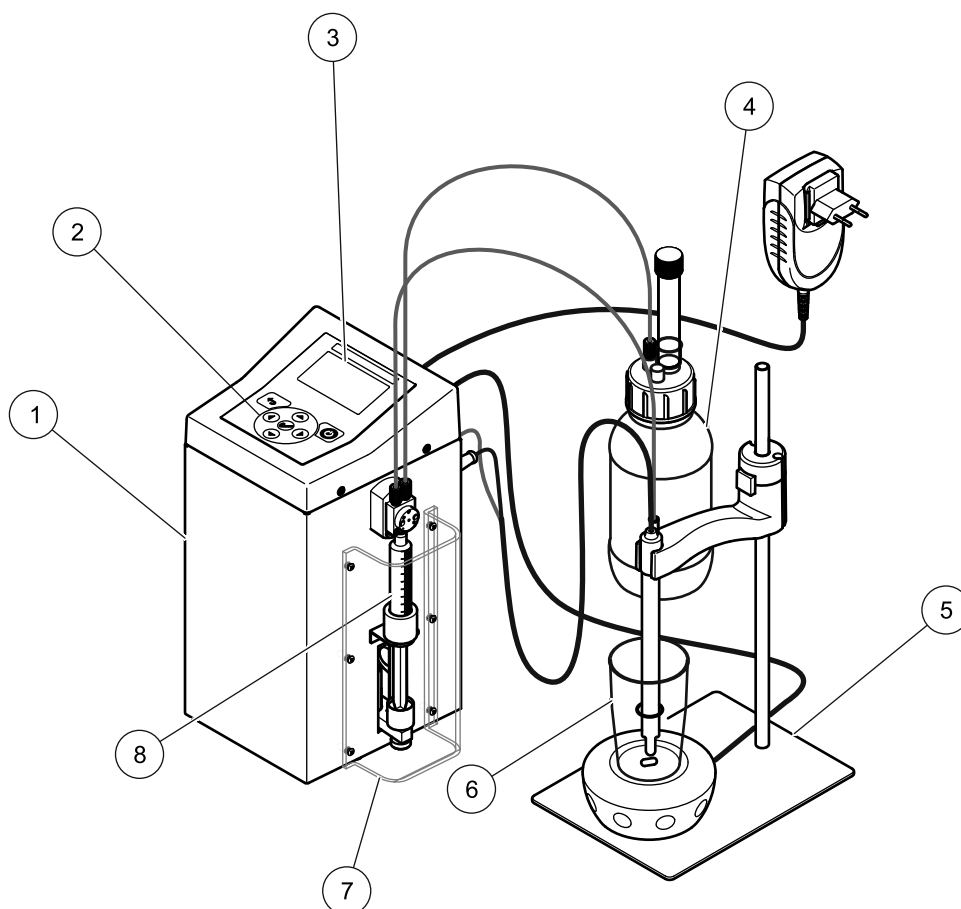
The TitraLab pH & Alkalinity content system is used for the titrimetric determination of alkalinity in waters. Intended for the analysis of natural, treated water and waste water.

- TitraLab can be used directly for waters having an alkalinity concentration of up to 20 mmol/L. For samples containing higher concentrations of alkalinity, a smaller test portion can be used for analysis. The recommended lower limit is 0,4 mmol/L.
- Alkalinity is measured by measuring the amount of acid (e.g., sulfuric acid) needed to bring the sample to a pH of 4.5 and 8.2. At this pH all the alkaline compounds in the sample are "used up." The result is expressed in calcium carbonate (CaCO_3).

TitraLab features an RS 232 C interface to enable communication with a computer or printer. Another port enables a mouse (optional) to be connected to perform all the functions of "OK". A convenient titration stand with stirrer is integrated.

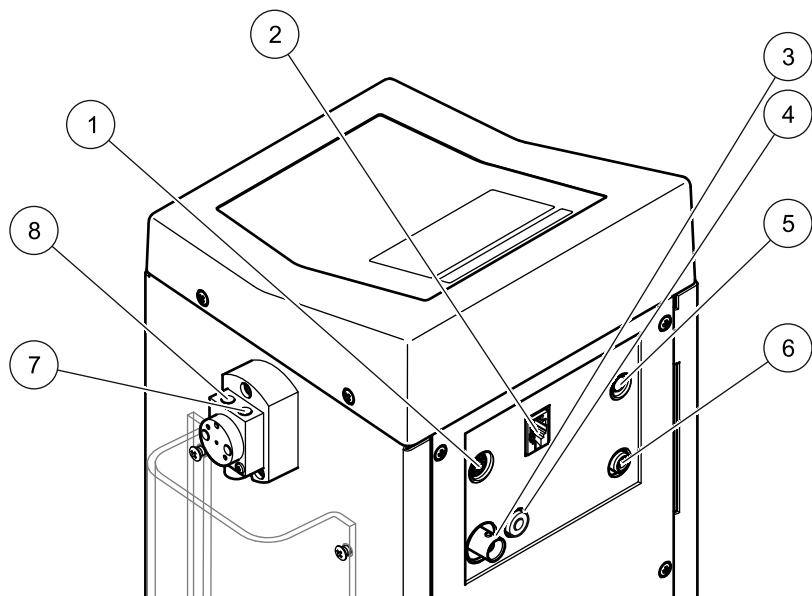
2.3 Front and back view

Figure 1 Front view



1	TitraLab pH & Alkalinity content system	5	Titration stand with magnetic stirrer
2	Keypad	6	Titration cell
3	Display	7	Syringe cover
4	Titrant	8	Burette

Figure 2 Back view



1	Connector for mouse	5	Connector for power supply
2	Connector for printer or computer	6	Connector for magnetic stirrer
3	Electrode connector	7	Burette valve, IN socket
4	Temperature connector of the electrode	8	Burette valve, OUT socket

DANGER

Only qualified personnel should conduct the tasks described in this section of the manual. Safety of any system incorporating this instrument is responsibility of the assembler of the system.

WARNING

Risk of injury to eyes, skin and respiratory
When working with chemicals and/or solvents, always observe the relevant accident prevention regulations and wear appropriate personal protective clothing for eye, face, hand, body and/or respiratory protection.
Make sure that the system is only unpacked, assembled, connected and operated by qualified and/or trained personnel.

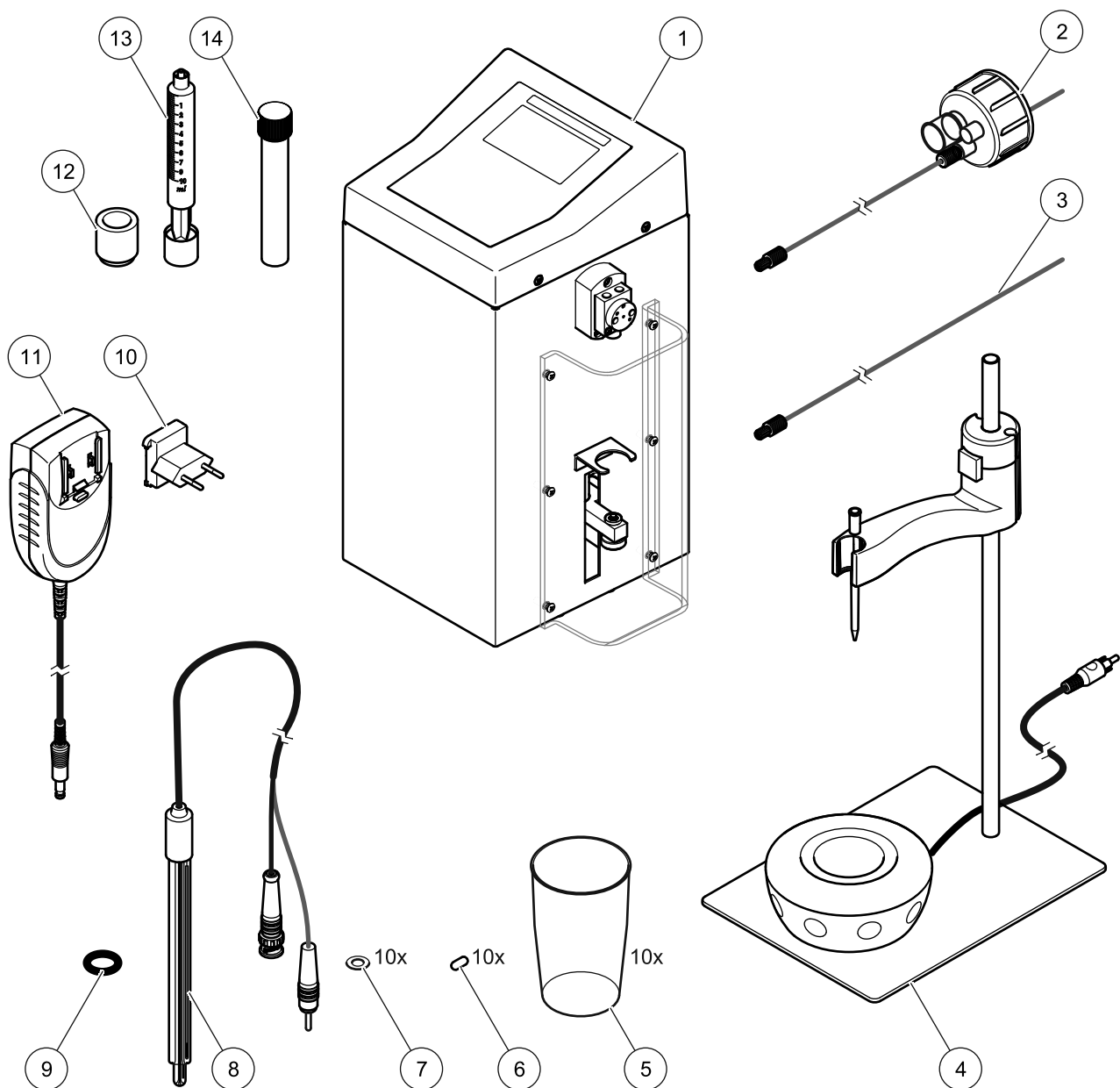
3.1 Unpack the instrument

Unpack all supplied parts carefully, as they are highly sensitive in part to shock and impact. Read the user manual prior to installation and proceed exactly as described.

3.2 Scope of delivery

Please check that the order is complete. If anything is missing or damaged, please contact the manufacturer or retailer.

Figure 3 Scope of delivery



1	TitraLab pH & Alkalinity content system	8	pH electrode with cable
2	Tube with bottle closure, DIN 45 thread	9	O-ring to secure tube
3	Tube to attach to electrode	10	Adapter for power supply
4	Titration stand holder including magnetic stirrer	11	Power supply, external
5	10x titration beakers, PP, 100 mL	12	Hardware sleeve
6	10x Teflon magnetic stirring bars (20 mm x 6 mm)	13	Syringe with plunger
7	10x white O-rings for burette and pump threads	14	Empty desiccant cartridge with stopper

3.3 Operating environment

⚠ WARNING

The instrument may not be used in dangerous environments.

The manufacturer and its suppliers reject any express or indirect guarantee for use with high-risk activities.

NOTICE

Protect the instrument from temperature extremes, including heaters, direct sunlight and other heat sources.

Note the following points so that the instrument will operate perfectly and have a long service life.

- Place the instrument firmly on an even surface. Do not push any objects under the instrument.
- The ambient temperature must be +15 to +40 °C (+60 to +104 °F).
- The relative humidity should be less than 80%; moisture should not condense on the instrument.
- A minimum clearance of 15 cm (5.9 in.) must be ensured above and on all sides of the device; this allows the air to circulate and prevents overheating of the electric parts. The dosage arm of the stepper motor must be able to move freely.
- Do not operate or store the instrument in extremely dusty, humid or wet locations.
- Make sure that no liquids enter the instrument and immediately wipe away any liquids that contact the instrument.
- Protect the instrument against vibrations, direct sunlight, corrosive gases as well as strong magnetic and/or electric fields.
- Only use genuine replacement parts and accessories.
- Install the instrument in a levelled place and on a compact surface to minimize the sound level of the instrument. This will avoid undesired resonances that can increase the sound level.
- Keep the surface of the instrument and all accessories clean and dry at all times. Splashes or spills on the instrument should be cleaned up immediately.

The instrument must be serviced by the manufacturer's service department at the prescribed intervals.

3.4 Installation

3.4.1 Installation of the burette

The burette dispenses the titrant: Hydrochloric acid (HCl) 0.1 N (0.1 M) or Sulfuric acid (H₂SO₄) 0.1 N (0.05 M).

The burette comprises the syringe, stepper motor and valve. The stepper motor and valve are already installed in the TitraLab; the syringe has to be installed by the user.

WARNING

Risk of injury to pinch points and cuts
Make sure that the titrator is never used/operated without the syringe cover.
Do not introduce your fingers on the bottom of the cover while the instrument is connected.
Make sure that the system is only assembled by qualified and trained personnel.

NOTICE

Warning against system damage
Make sure that the syringe is never operated without the attachment sleeve.
Only use genuine replacement parts and accessories.
The instrument must be serviced by the manufacturer's service department at the prescribed intervals.

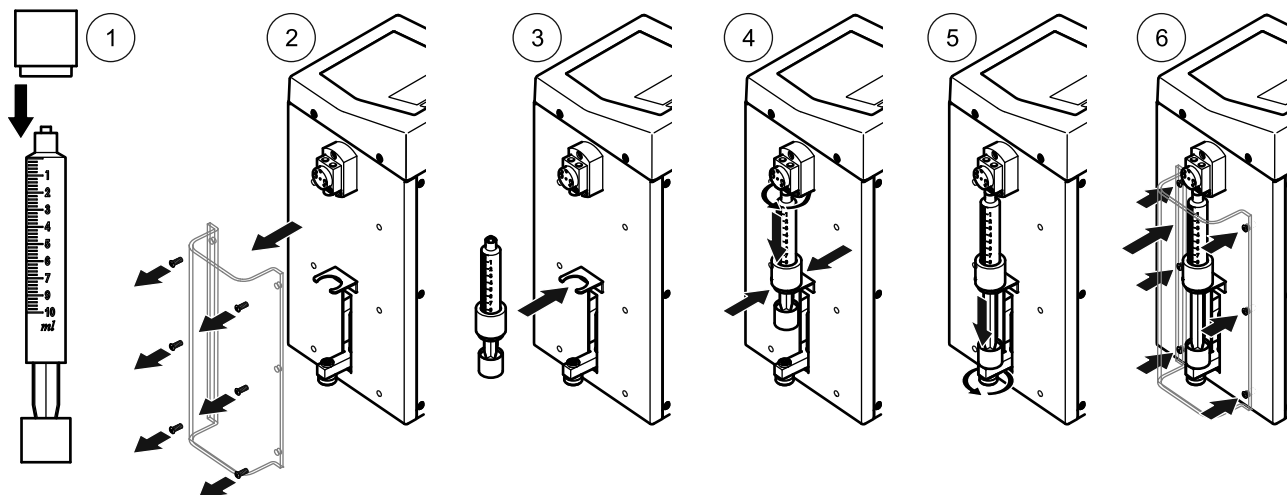
Note: Make sure that you do not misplace the attachment sleeve for the syringe. It is not provided with a new syringe.

1. Push the syringe piston into the syringe body.
Slide the attachment sleeve fully onto the syringe so that the narrow end points toward the piston.
2. Remove the syringe cover by unscrewing it.
3. Point the syringe tip upward, place the syringe into the bracket such that the attachment sleeve is above the bracket.
4. Hold the attachment sleeve in the bracket and screw the syringe onto the valve from below.
With the narrow side facing down, carefully press the attachment sleeve into the bracket.
5. Withdraw the piston from the syringe and place it onto the screw in the dosage arm.
Hold the syringe piston and turn the attachment screw on the dosage arm into the thread in the piston.
6. Fix the syringe cover with six screws.

WARNING

Risk of injury to eyes, skin and respiratory
During the first days of system use, check the screw joint between the syringe and valve to avoid leaks and the potential escape of reagents.
When working with chemicals and/or solvents, always observe the relevant accident prevention regulations and wear appropriate personal protective clothing for eye, face, hand, body and/or respiratory protection.

Figure 4 Installation of the burette



1	Push the piston into the syringe body. Slide the attachment sleeve onto the syringe.	4	Screw the syringe tip onto the valve. Place the attachment sleeve into the bracket.
2	Unscrew the six screws and remove the syringe cover.	5	Screw the piston onto the dosage arm.
3	Insert the syringe into the bracket.	6	Fix the syringe cover with six screws.

3.4.2 Installation of the titration stand

The titration stand consists of a holder onto which the electrode, titration cell and magnetic stirrer are attached. The titration is performed in the titration cell.

1. Place the titration stand on the right side (syringe side) of the titrator (observe the routing of the cable).
2. Place a magnetic stirring bar into a titration cell.
Place a titration cell over the magnetic stirrer.
3. Place the rubber ring on the stand rod to set the minimum height of the electrode holder.
4. Press the button to lock the electrode holder and place the electrode holder on the stand rod. The electrode holder is locked upon release of the button.
5. Remove the white cap from the tip of the electrode.
Insert the electrode into the electrode holder.

NOTICE

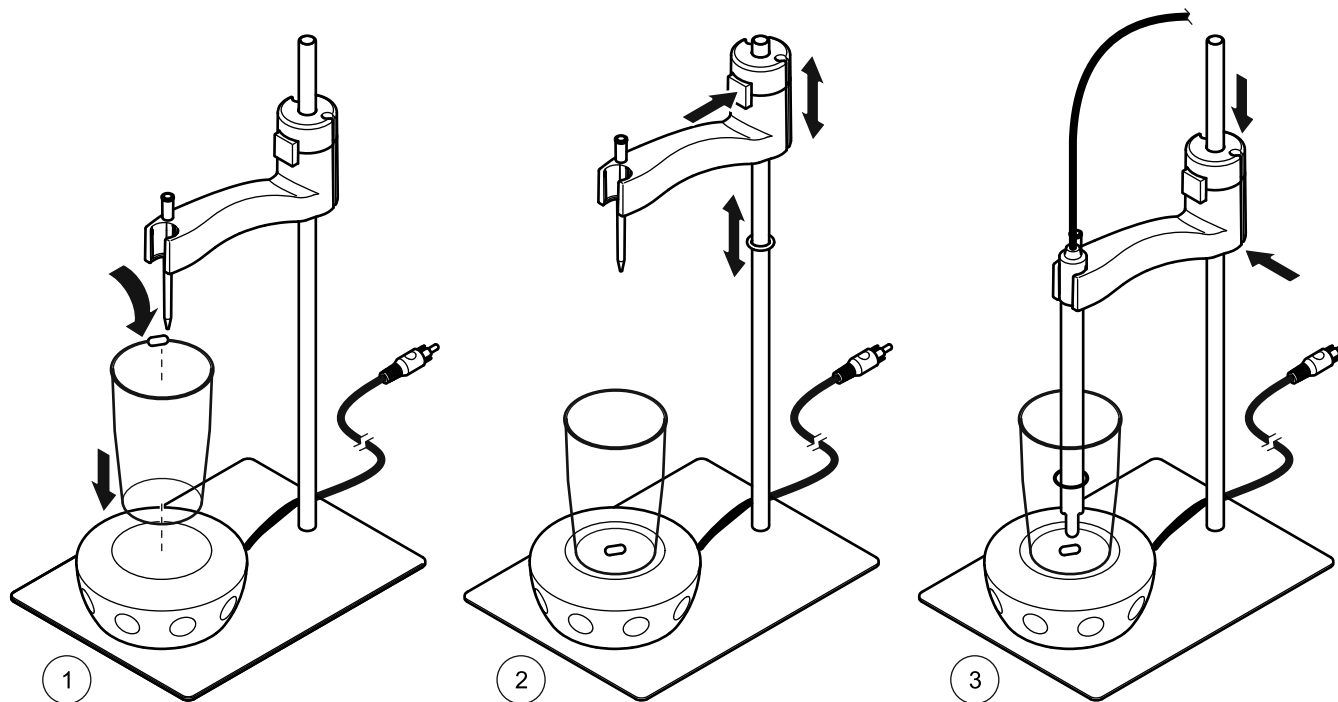
Warning against system damage

Make sure that the height setting of the electrode holder protects the electrode against damage from the stirring bar and against contact with the bottom of the titration cell.

Keep the lock button pressed whenever the electrode holder is being moved.

Note: Whenever the electrode is taken from the titration stand or the titration cell is removed from the titration stand, always place a container beneath the electrode. Otherwise, drips from the sample or chemicals could contaminate the work area.

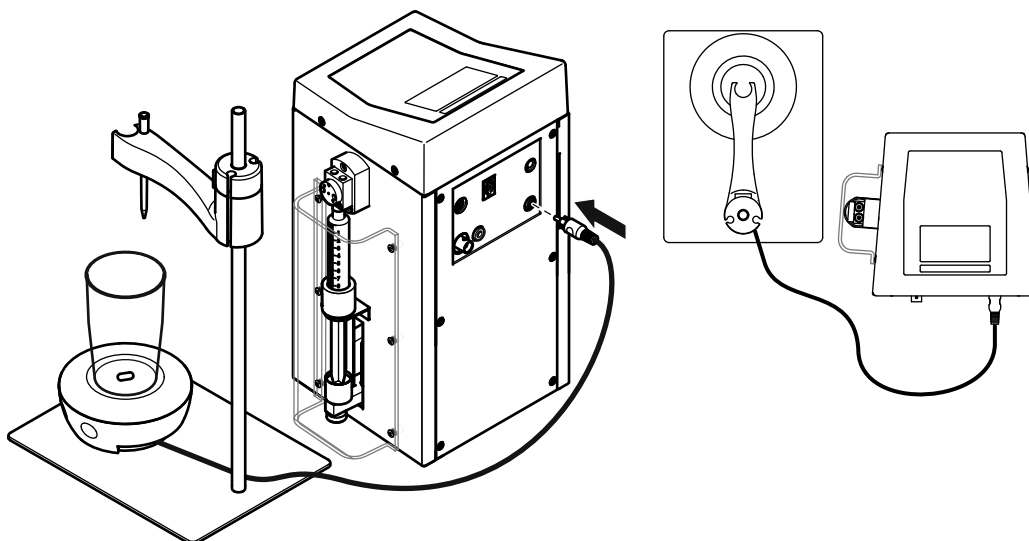
Figure 5 Installation of the titration stand



- | | |
|---|--|
| 1 Place a magnetic stirring rod in a titration cell. Place a titration cell over the magnetic stirrer. | 3 Insert the electrode and adjust the height of the electrode holder. |
| 2 Position a rubber ring on the stand rod to set the minimum height of the electrode holder. Press the electrode holder lock button and place the electrode holder on the stand rod. | |

3.4.2.1 Electrical connection of the magnetic stirrer

1. Connect the cable of the magnetic stirrer to the **STIRRER** port on the back of the TitraLab.
The power is supplied via the TitraLab.

Figure 6 Electrical connection of the magnetic stirrer

- 1 Connect the cable of the magnetic stirrer to the **STIRRER** port.

3.4.3 Installation of tubes

⚠ WARNING

Risk of injury to eyes, skin and respiratory

During the first days of system use, check the screw joint between the syringe and valve to avoid leaks and the potential escape of reagents.

When working with chemicals and/or solvents, always observe the relevant accident prevention regulations and wear appropriate personal protective clothing for eye, face, hand, body and/or respiratory protection.

Make sure that the tubes are never kinked.

Regularly check the system as well as all tubes and connections for leaks, condition and cleanliness.

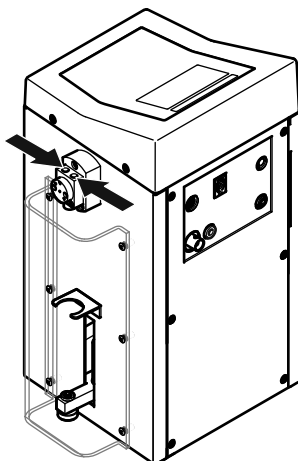
To prevent twisting of the tubes, you should always connect flange tube connections before those with grommets.

The system is delivered with two tubes; these are supplied pre-installed on the TitraLab and only need to be connected to the relevant titrant bottle and to the electrode.

3.4.3.1 Removal of protective stickers (Uninstalled tubes configuration)

1. Remove the protective stickers on the burette valve.
2. Make sure that the pre-installed white O-rings are not removed.
3. Check that the O-rings are in a horizontal position inside the thread.

Figure 7 Position of protective stickers

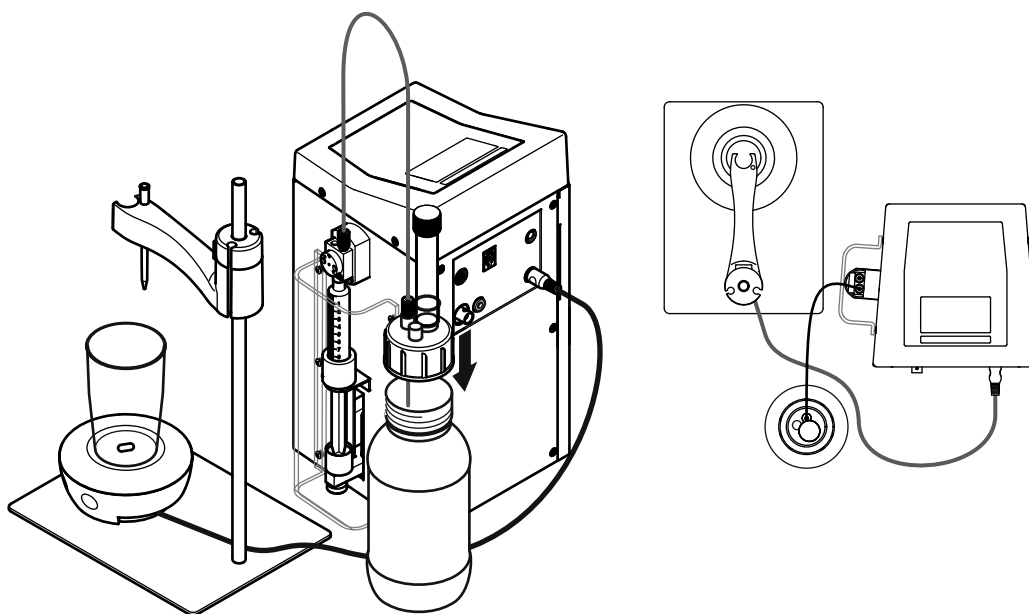


3.4.3.2 Connection of feed tube

The system is delivered with a tube with bottle closure (DIN 45 thread). This feed tube is supplied pre-installed on the TitraLab and only needs to be connected to the titrant bottle.

1. Connect the tube from the IN socket of the burette valve to the titrant bottle (HCl or H_2SO_4). Screw on the bottle closure to do this.

Figure 8 Connection of feed tube



3.4.4 Connection of the electrode

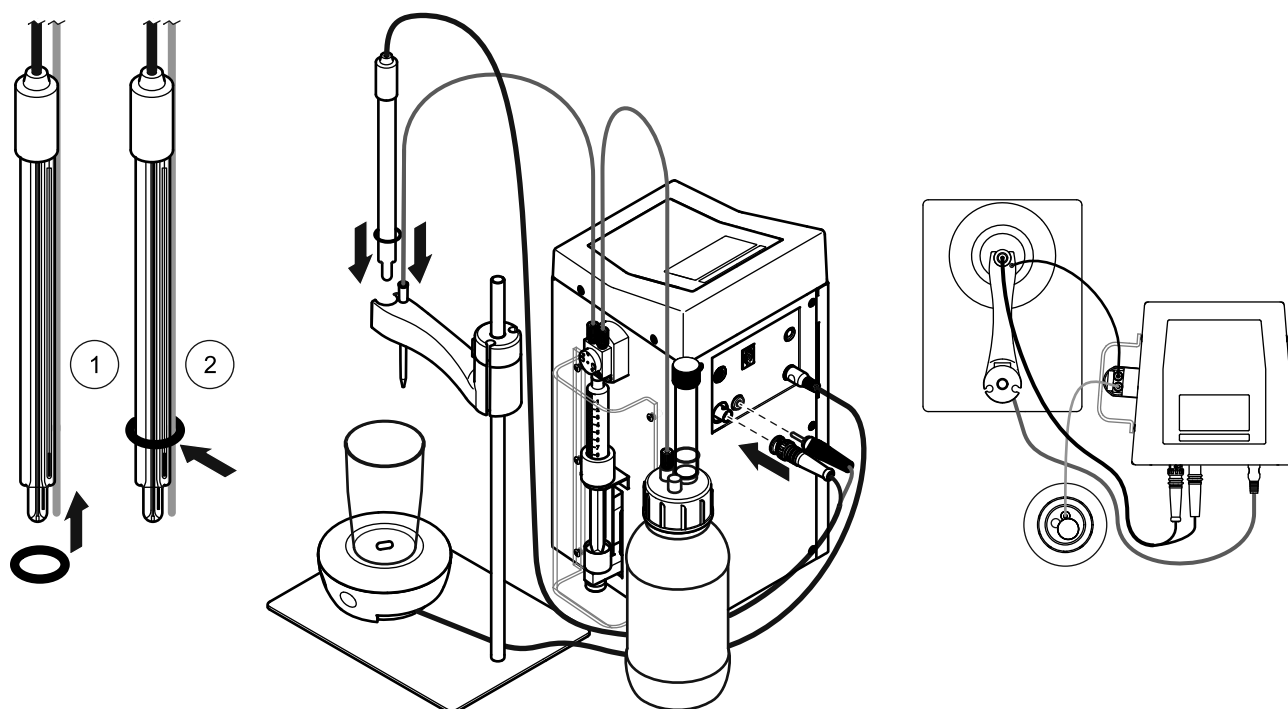
1. Connect the electrode cable to the **ELECTRODE** port on the back of the TitraLab. The power is supplied via the TitraLab.

3.4.4.1 Connection of the tube to the electrode

The sensor holder has a tube guide.

1. Connect the tube on the OUT socket of the burette valve.
2. Place the electrode in the sensor holder.
3. Insert the tube into the cannula of the sensor holder.
Push the free end of the tube into the tube guide of the sensor holder until the end of the tube is flush with the tip of the electrode (1).
4. Attach the tube to the electrode with a rubber ring (2).

Figure 9 Connection of the electrode



3.4.5 Power supply, external

⚠ DANGER

Risk of electric shock

Make sure the AC supply voltage is suitable for the power supply and the mains plug style is suitable for the type of outlet socket.

Only use the original power supply and plug connectors.

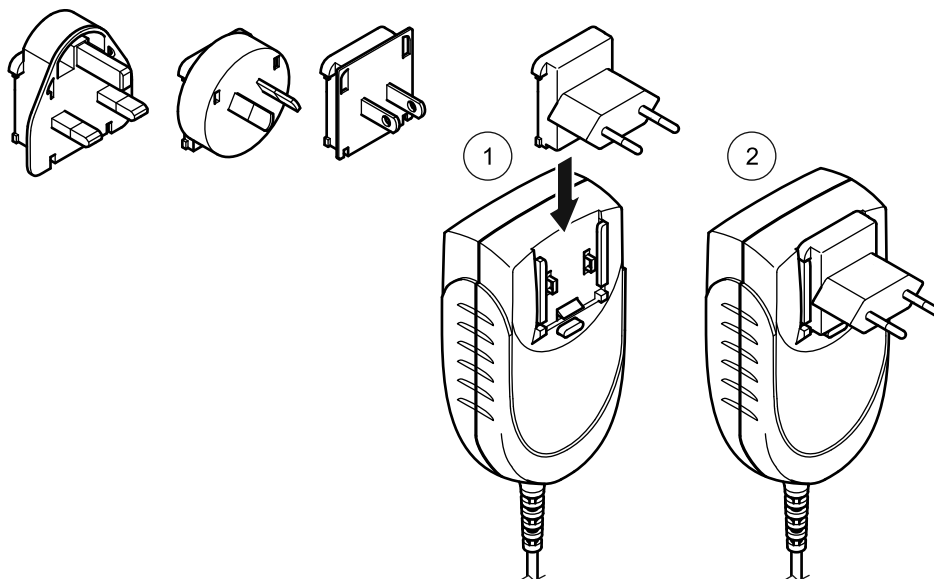
⚠ DANGER

Fire and electrical shock hazard.

Take care, when using chemical products and liquids, to avoid dropping them on the power supply or mains connections.

The power supply is provided with different plug connectors. The correct plug connector must be attached to the power supply before first use.

Figure 10 Plug connector attachment



1 Slide the plug connector into the power supply

2 Click the plug connector into place

Note: To change the plug connector, press in the catch and slide the plug connector upward.

3.5 Keypad

Navigation key UP

- Used to select between different options on the display.
- Increases numeric values.
- Shows the previous data record in the data log menu.
- Empties the syringe through the discharge tube during manual activation.

Navigation key DOWN

- Used to select between different options on the display.
- Reduces numeric values.
- Shows the next data record in the data log menu.
- Fills the syringe through the feed tube during manual activation.

ON/OFF key

Navigation key LEFT

- Moves the cursor backward for entry of numeric values.
- Scrolls up in menus.
- Empties the syringe through the feed tube during manual activation.

Navigation key RIGHT

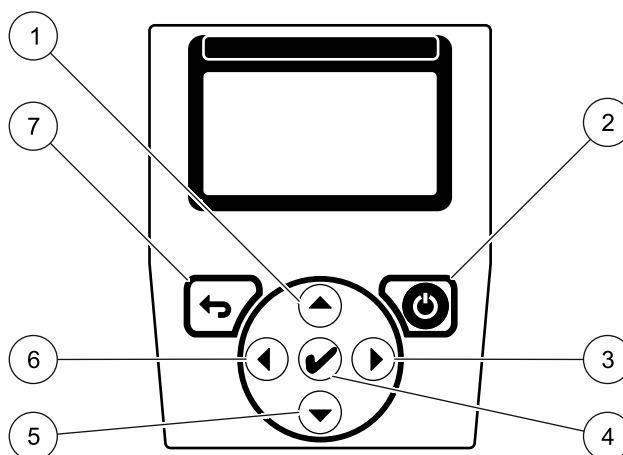
- Moves the cursor forward for entry of numeric values.
- Scrolls down in menus.

RETURN key

- Scrolls back in menus.
- Cancels a manual control.
- Cancels a titration.

OK key (Check mark)

- Confirms the gray-highlighted menu items and scrolls forward in the menu.
- Shows the first data record in the data log.

Figure 11 Keypad

1	Navigation key UP	5	Navigation key DOWN
2	ON/OFF key	6	Navigation key LEFT
3	Navigation key RIGHT	7	RETURN key
4	OK key (Check mark)		

3.5.1 Optical mouse (optional)

On TitraLab pH & Alkalinity, all functions executed with OK can also be performed with an optical mouse.

1. Connect the mouse cable to the port labeled **MOUSE** on the back of the TitraLab. The power is supplied via the TitraLab.

3.6 Reagents

Titrant reagent:

- Hydrochloric acid (HCl) 0.1 N (0.1 M)
- Sulfuric acid (H₂SO₄) 0.1 N (0.05 M)

Section 4 Operation

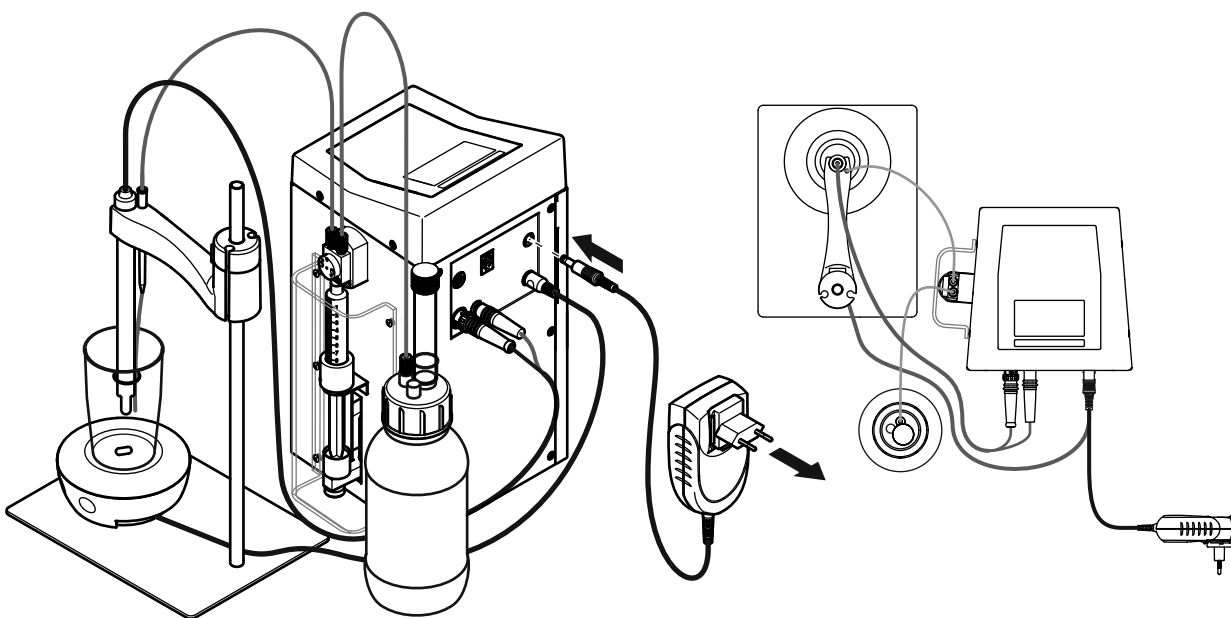
4.1 Switch on the instrument

Become familiar with the instrument functions before operation. Learn how to navigate through the menu and perform the relevant functions.

1. Connect the input connector of the power supply to the **POWER IN** port on the back of the TitraLab.
2. Connect the power supply to a power socket.
3. Press **ON/OFF** below the display to switch on the instrument.
4. The instrument performs a self-test upon each activation.

Note: Wait approximately 20 seconds before switching on again so as not to damage the electronics and mechanics of the instrument

Figure 12 Switch on the instrument



4.2 Startup

4.2.1 Language and data output setting

The titrator software supports multiple languages. The first time the instrument is switched on, a language selection list is displayed automatically upon completion of the self-test.

1. Select the required language.
2. Press **OK** to confirm the selection.
3. Select the type of data output (deactivated, printer, computer) and confirm with **OK**.

4.2.1.1 Change the language setting

The instrument functions in the selected language until the option is changed.

1. Turn the instrument on.
2. Select **SYSTEM > LANGUAGE**.
3. Select the required language.
4. Press **OK** to confirm the selection.

4.2.1.2 Change the data output setting

The instrument functions in the selected data output until the option is changed.

1. Turn the instrument on.
2. Select **SYSTEM > DATA OUTPUT**.
3. Select the required setting.
4. Press **OK** to confirm the setting.

4.2.2 First steps after installation

WARNING

Risk of injury to eyes, skin and respiratory

Make sure that the reagent tubes are in the correct position in the titration cell to avoid leaks and the potential escape of reagents.

1. Prime the burette with titrant ([4.8.1 Burette](#)).
2. Check the stirring speed ([4.8.2 Stirrer](#)).

4.3 Menu structure

Section 6 Troubleshooting provides a list of all error and warning messages, and also describes all necessary countermeasures.

MAIN MENU	
ANALYZE PH+ALKALINITY	Titration program to determine pH and Alkalinity content.
Insert Sample: 1	Dispense the sample in a titration cell (50.0 mL).
Start Analysis	Start analysis.
MEASURE PH	Sample pH.
By Stability	pH shown on display once stable.
Start Measurement	Start measurement.
In Continuous	pH continuously shown on display and, if a PC or printer is connected, transferred at a defined interval.
Start Measurement	Start measurement.
PH CALIBRATION	pH calibration, either one, two or three-point.
Immerse the pH electrode in the first buffer.	Place pH 7.00 calibration solution in a titration cell.
Start	Start calibration of the first point.
Finish Calibration	Finish as one-point calibration.
Next Point	Place pH 4.00 calibration solution in a titration cell.
Start	Start calibration of the second point.
Finish Calibration	Finish as two-point calibration.
MANUAL ACTIVATION	Select which element is to be controlled manually; refer to section 4.8, page 29 .
Burette	Manual control of burette.
Return	Empties the burette into the titrant bottle (navigation key LEFT).
Empty	Empties the burette into the titration cell (navigation key UP).
Fill	Fills the burette with titrant (navigation key DOWN).
Stirrer	Sets the stirring speed. Select ON/OFF with OK. Select the stirring speed with UP/DOWN.

Operation

MAIN MENU	
SYSTEM	System settings; refer to section 4.9, page 30 .
Units Alkalinity	The unit and factor to determine alkalinity can be adjusted individually. By default: mg/L CaCO ₃
Unit	Unit selection.
meq/L CaCO ₃	
mmol/L CaCO ₃	
ppm CaCO ₃	
mg/L CaCO ₃	
dGH	
°dH	
gpg	
°e	
°Clark	
°F	
Factor	The factor must be adjusted individually. Default value F= 100.09 Calculated for HCl or H ₂ SO ₄ 0.1 N Sample volume: 50 mL Results expressed in mg/L CaCO ₃
End Point Value	Setting for titration end point.
p value: pH 8.20	1st pH end point 8.20 (in accordance with ISO 9963-1).
m value: pH 4.50	2nd pH end point 4.50 (in accordance with ISO 9963-1).
Data Logger	Data log with up to 55 results; refer to section 4.9.3, page 31 .
Empty Data-Logger	Empties the data log.
Display Data	Display results with search filters.
By Date:	Display results by date.
Continue...	Display all results.
Data Output	Define the data output; refer to section 4.9.4, page 31 .
Deactivated	Deactivates the data output.
For Printer	Activates data output on the printer.
For Computer	Activates data output on the computer.
Calibration Validity	Validity of current calibration in days and hours.
Date / Hour	Entry of date and time.
Display Contrast	Selection of display contrast.
Language	Selection of operating language.
SPANISH	
ENGLISH	
ITALIAN	
FRENCH	
Theoretical Cal.	If no current calibration is available, the system can revert to a theoretical calibration.

4.4 pH and Alkalinity content

1. Place a magnetic stirring bar in a titration cell and dispense the sample as follows:
 - Add 50 mL of the sample water.
2. Place the titration cell over the magnetic stirrer.
3. Lower the electrode into the titration cell.

Note: Make sure that the electrode cannot be damaged by the stirring bar or come into contact with the bottom of the titration cell. Make sure the combined pH Electrode, including the reference element porous pin is covered by sample.

4. Select **ANALYZE PH + ALKALINITY**. "INSERT SAMPLE: 1" is shown on the display.
5. Select **START ANALYSIS**.

The following steps are carried out automatically by TitraLab:

- Measurement of pH
 - Subsequent commencement of titration
6. The result is shown on the display and, depending on the setting, sent to a printer or computer.
 7. Press **OK** to confirm the result.
 8. To begin another analysis, select **OK**. "NEXT SAMPLE" is shown on the display.

4.5 pH measurement

1. Place a magnetic stirring bar and the sample in a titration cell.
2. Place the titration cell over the magnetic stirrer.
3. Lower the electrode into the titration cell.

Note: Make sure that the electrode cannot be damaged by the stirring bar or come into contact with the bottom of the titration cell. Make sure the combined pH Electrode, including the reference element porous pin is covered by sample.

4. Select **MEASURE PH**. "STABILITY" or "CONTINUOUS" is shown on the display.
 - **STABILITY:** pH is shown on the display once stable.
 - **CONTINUOUS:** pH is continuously shown on the display and, if a PC or printer is connected, transferred at a defined interval.
5. Select **START MEASURING**.
6. The result is shown on the display and, depending on the setting, sent to a printer or computer.
7. Press **OK** to confirm the result.
8. To begin another analysis, select **OK**. "NEXT SAMPLE" is shown on the display.

4.6 pH calibration

1. Place a magnetic stirring bar and pH 7.00 calibration solution in a titration cell.
2. Attach the titration cell to the magnetic stirrer.
3. Lower the electrode into the titration cell.

Note: Make sure that the electrode cannot be damaged by the stirring bar or come into contact with the bottom of the titration cell. Make sure the combined pH Electrode, including the reference element porous pin is covered by sample.

4. Select **PH CALIBRATION**. "**IMMERSE THE PH ELECTRODE IN THE FIRST BUFFER.**" is shown on the display.
5. Select **START**.
6. Following successful calibration, "**NEXT POINT**" or "**FINISH CALIBRATION**" is shown on the display.
 - **FINISH CALIBRATION:** Calibration finished as one-point calibration.
 - **NEXT POINT:** Place a magnetic stirring bar and pH 4.00 calibration solution in a titration cell. Continue as described.
7. "**IMMERSE THE PH ELECTRODE IN THE SECOND BUFFER.**" is shown on the display.
8. Select **START**.
9. Following successful calibration, "**FINISH CALIBRATION**" is shown on the display.
10. Press **OK** to confirm.

4.7 pH calibration with a user define control solution

A user define pH calibration solution can be entered as a third calibration point. A two-point calibration must be performed first (refer to [4.6 pH calibration](#)). After this, proceed as follows:

1. Place a magnetic stirring bar and the required amount of the special calibration solution in a titration cell.
2. Attach the titration cell to the magnetic stirrer.
3. Lower the electrode into the titration cell.

Note: Make sure that the electrode cannot be damaged by the stirring bar or come into contact with the bottom of the titration cell. Make sure the combined pH electrode, including the reference element porous pin is covered by the solution.

4. Select **MEASURE PH**. "STABILITY" or "CONTINUOUS" is shown on the display.
5. Select **STABILITY**.
6. Select **START MEASURING**.
7. The result is shown on the display and, depending on the setting, sent to a printer or computer.
8. Press the **UP** navigation key for two seconds.
9. "CONTROL SOLUTION" and the measured pH are shown on the display.
10. Use the **UP** and **DOWN** navigation keys to adjust the measured pH to the specified standard value for the control solution.
11. Press **FINISH** to confirm the entry.
12. Press **OK** to confirm.

4.8 Manual component activation

4.8.1 Burette

1. Select **MANUAL ACTIVATION > BURETTE** and press **OK** to confirm.
 - Select **FILL** with the **DOWN** navigation key to fill the burette.
 - Select **EMPTY** with the **UP** navigation key to empty the burette into the titration cell.

Note: Repeat this procedure (FILL/EMPTY) multiple times to make sure that the dispensing process functions correctly.

- Select **RETURN** with the **LEFT** navigation key to empty the burette back into the titrant bottle.

4.8.2 Stirrer

1. Select **MANUAL ACTIVATION > STIRRER** and press **OK** to confirm.
2. Press **OK** to switch the stirrer on or off.
3. Use the navigation keys **UP** and **DOWN** to select the stirring speed.

4.9 System

This function can be used to adapt the titrator to specific requirements.

4.9.1 Alkalinity units

The unit and factor for calculation must be adjusted individually.

By default the instrument will calculate the alkalinity in mg/L CaCO_3 . $F = 100.09$

Valid only if:

Titration reagent: HCl 0.1 N

Sample Volume: 50 mL

Tabelle 1 Conversion table

	mmol/L	ppm, mg/L	°dH, dGH	gpg*	°Clark, °e	°F
mmol/L	1	0.009991	0.1783	0.171	0.1424	0.09991
ppm, mg/L	100.1	1	17.85	17.12	14.25	10
°dH, dGH	5.608	0.05603	1	0.9591	0.7986	0.5603
gpg	5.847	0.05842	1.043	1	0.8327	0.5842
°Clark, °e	7.022	0.07016	1.252	1.201	1	0.7016
°F	10.01	0.1	1.785	1.712	1.425	1

4.9.2 End Point Value

Setting for titration end point. The end point can be pH 8.20 and pH 4.50 and correspond with the provisions of the norm ISO 9963-1:
1994 Water quality - Determination of alkalinity -

4.9.3 Data Logger

This section describes the functions of the data log.

- Up to 55 results are stored.
 - The results can be displayed, printed or sent to a computer.
 - When the data log is full, the oldest result is overwritten automatically.
1. Select **SYSTEM > DATA LOGGER > DISPLAY DATA** and press **OK** to confirm. A range of search filters can be used to display the results.
BY DATE: displays the results for a specific date.
CONTINUE: displays all results.
 2. To empty the data log, select **SYSTEM > DATA LOGGER > EMPTY DATA-LOGGER** and press **OK** to confirm.

4.9.3.1 Sample numbers

When a titration program is started, the first sample is assigned the number 1. All subsequent samples receive sequential numbers until the titration program is closed. When the program is launched again, the sequential numbers are reset to 1.

4.9.4 Data Output (printer/computer)

This function is only displayed if a printer or computer is connected and activated for data output. Programs, settings and results can be printed or transferred. Following a titration or calibration, the following data is printed or transferred:

- Type of analysis, date and time, titration result, titrant end volume, duration of titration and sample number.
1. Select **SYSTEM > DATA OUTPUT**.
 2. Select **FOR PRINTER** followed by the relevant printer model, such as thermal or dot matrix. Confirm with **OK**.

Select **FOR COMPUTER** followed by either **CAPTURE** or **TICOM**. Confirm with **OK**.

4.9.5 Calibration validity

The validity of the last pH calibration can be defined in days and hours.

4.9.6 Date/Hour

Entry of date and time.

4.9.7 Display contrast

Increases or decreases the display contrast.

4.9.8 Language

English, Spanish, Italian, French.

4.9.9 Theoretical Cal.

When no current calibration is available, the system can revert to a theoretical calibration. The current state of the electrode is not factored into the theoretical calibration.

WARNING

Risk of injury

Before maintenance or repair work is conducted, thoroughly rinse the instrument with deionized water and make sure that there are no residual chemicals in the tubes and pumps.

Only use genuine replacement parts and accessories.

The instrument must be serviced by the manufacturer's service department at the prescribed intervals.

After maintenance tasks or service, the following points have to be checked:

- The housing of the instrument has to be closed correctly using the corresponding screws.
- Check the syringe cover for fissure or damage, replace if necessary. The syringe cover has to be attached firmly to the instrument using the corresponding screws.
- Place the instrument firmly on an even surface.

5.1 Maintenance schedule

Maintenance task	Every week	6 months	12 months
Check all tube connections for leaks and damage.	x	x	
Replace burette syringe		x	
Check valve block			x
Burette feed tube			x
Burette discharge tube			x
Bottle closure set			x
Check syringe and syringe connection for leaks and damage	x		

5.2 Power off the instrument

At the end of the working day, deactivate the instrument as follows:

- Empty the contents of the burette into the titrant bottle; refer to [section 4.8.1, page 29](#).
- Empty and clean the used titration cells with deionized water.

When the instrument is to be deactivated for multiple days or extended periods, perform the following steps:

- Clean the burette with deionized water.
- Seal the reagent bottles with the original bottle closures.
- Empty and clean the used titration cells with deionized water.

5.3 Clean the burette

Make sure that there are no crystals or other sediments inside the syringe. If such deposits are discovered, clean the syringe immediately, as this will otherwise damage the plunger.

5.4 Clean the electrode

Rinse the electrode with deionized water in order to clean it. Never use organic solvents to clean the electrode.

The pH electrode must always be kept wet in a KCl solution when stored. To do this, fill the protective cap with some KCl solution.

Never store the pH electrode in deionized water.

Section 6 Troubleshooting

6.1 Error messages

Error displayed	Cause	Resolution
Maximum volume reached.	The maximum volume is reached before the titration is completed. The titration is cancelled automatically.	Empty the titration cell and restart the titration.
Expired calibration.	Validity of calibration has expired.	Perform new calibration.
Data logger empty.	No results are stored or no results match the search filter.	Change the search filter criteria.
All data will be erased.	All data in the data log will be erased.	
Printing error.	Printer is connected but not activated.	Switch on the printer.
PC not connected.	Computer is activated but not connected.	Check the computer connection.
Unstable pH reading.	Defective pH electrode and/or insufficient immersion.	Check electrode according to manufacturer recommendations, maintain electrode as required. Check porous pin is covered by sample.

Section 7 Replacement parts and accessories

NOTICE

Warning against system damage

Only use genuine replacement parts and accessories.

The instrument must be serviced by the manufacturer's service department at the prescribed intervals. Do not attempt to service this product yourself, except as noted in the user manual.

7.1 Replacement parts

Description	Cat. No
TitraLab pH & Alkalinity in water, with 1x 10 mL syringe. Accessories included: electrode holder with magnetic stirrer, pH combined electrode, 10 titration cells and stirring bars	LLV2309.97.1002
pH combined electrode, pH 0 to 14, -10 to +100 °C	LZW5014T.97.002
Titration stand with sensor support for TitraLab pH & Alkalinity, includes magnetic stirrer	LZW2331.99
Magnetic stirrer for titration stand Alkalinity & Hardness	LZW2330.99
10x Teflon magnetic stirring bars, (20 x 6 mm)	LZW9339.99
Titration Vessel, PP, 40-100 mL (pack of 50 pcs)	904-490
Plastic syringe, 10 mL	LZW2323.99
Hardware sleeve for syringe	LZW8743.99
Inlet tube for burette/pump, L = 65 cm, d = 2.5 x 1.5 mm, with R6 racord	LZW8705.99
Outlet tubes set for burette. L = 55 cm, d = 2 x 1 mm, with R6 racord	LZW8709.99
Screw cap DIN 45	LZW8729.99
10x replacement O-rings for tube connections	LZW8734.99
Cotton filter cartridge for reagent bottle cap	LZW9199.99
Electro-valve for Burette	LZW9249.99

7.2 Accessories

Description	Cat. No
3-button mouse	LZW9240.99
Standard PC keyboard, mini-DIN connector.	LZW9013.99
RS 232 C cable for connection between titrator and PC, with 9-pin and USB connectors	LZW9135USB.99
KyoMouse RS Thermal Ticket Printer with connection cable.	LZW8204.99
5 rolls thermal paper for KyoMouse, 5 year warranty	LZW8206.99

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